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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/940,247	08/27/2001	Takamasa Ito	NEC 2360	6115

7590 07/16/2003

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EXAMINER

VINH, LAN

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 07/16/2003

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/940,247

Applicant(s)

ITO, TAKAMASA

Examiner

Lan Vinh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 April 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☐ Claim(s) 1-5 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☒ Certified copies of the priority documents have been received in Application No. 09/940,247.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

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DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claim 1-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suguro (US 6,033,537) in view of Lee et al (US 6,074,960)

Suguro discloses a method for manufacturing a semiconductor device (MOS transistor), the MOS transistor having a self-aligned metal silicide layer 20 on a source/drain region 18 and gate electrode 14 formed on a semiconductor substrate 11 (col 10, lines 40-43 ;fig. 8E). This method comprises the steps of:

completely covering the substrate 11 with gate electrode 14 with a cobalt film 19 (col 10, lines 22-23; fig. 8D), which reads on depositing a cobalt film over an entire surface of the semiconductor device formed on the semiconductor substrate

annealing/heat treating the cobalt film 19 at 500-600⁰ C to form cobalt silicide layer 20 on the gate electrode and the source/drain region 18 (col 10, lines 37-42)

removing/etching away the unreacted cobalt film 19 remaining on the semiconductor substrate using an etching solution containing hydrochloric acid, hydrogen peroxide and water (col 11, lines 13-19), fig. 8F of Suguro shows that cobalt silicide layer 20 is not removed during the etching step

Unlike the instant claimed invention as per claim 1, Suguro fails to explicitly specify a concentration of hydrochloric acid, hydrogen peroxide and water in the range of 1:1:5 to 3:1:5, a solution temperature of 25-45⁰ C and an etching time of 1-20 minutes.

However, Lee discloses a method for selectively etching against cobalt comprises the step of removing/etching away the unreacted cobalt film using an etching solution containing hydrochloric acid, hydrogen peroxide and water having a concentration of 1:1:5 (col 6, lines 20-45; col 8, lines 40-43), the etching is carried out at a temperature of 20-100⁰ (col 5, lines 63-64), which overlaps the claimed range of 25-45⁰ C. Lee also discloses that the thickness of the cobalt layer is 1000 angstroms (col 3, lines 65-66) and the etching solution etches unreacted cobalt at a rate of 1000angstrom/minute (col 6, lines 8-10), which is interpreted by the examiner as performing the etching step in 1 minute. In addition, Lee also discloses that the etching rate of cobalt changes/varies as the concentration of the etching solution changes (col 7, lines 22-42) and the etching rate of cobalt also changes depending on the soaking time/etching time and temperature (col 7, lines 46-48)

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Thus, Lee serves as evidence that the concentration of the etchants in the etching solution, the temperature of the etching solution and etching time are so-called "result effective variable". Hence, one skilled in the art would have found it obvious to modify Suguro by discovering the optimum values for concentration, temperature and time because Lee discloses that these are result effective variables. In addition, it has been held that the discovery of an optimum value for result effective variables is within the purview of routine experimentation by the person of ordinary skill in the art. *In re Boesch*, 617 F.2d 272, 276, 205 USPQ 215, 219 (CCPA 1980)

The limitation of claim 2 has been discussed above.

Regarding claim 3, Suguro discloses the step of annealing/heating the cobalt film at 500-600⁰ C (col 10, lines 37-38)

Regarding claim 4-5, Suguro discloses the step of heating the silicide layer at 800-900⁰ C (col 11, lines 20-22)

Response to Arguments

3. Applicant's arguments filed 4/28/2003 have been fully considered but they are not persuasive.

The applicants argue that the primary reference of Suguro fails to teach the limitation of to remove unreacted or partially oxidized cobalt while leaving the metal silicide layer intact. This argument is unpersuasive for two reasons. First at all, this argument does not commensurate with the scope of claim 1 since the term "or partially oxidized " is not recited in claim 1. In addition, fig. 8F of Suguro clearly shows that unreacted cobalt layer 19 is removed by the etching step while cobalt silicide layer 20 is not removed during the etching step. Thus, the examiner asserts that Suguro teaches the step of removing unreacted cobalt while leaving the metal silicide layer intact.

The applicants further argue that Lee et al.'s one step etching solution is significant more dilute than required by applicant's claims. The examiner disagrees because as clearly recited in col 6, lines 44-46 of Lee, Lee discloses using an etching solution containing hydrochloric acid, peroxide and water having a concentration of 1:1:5 which certainly reads on the claimed solution made of hydrochloric acid, hydrogen peroxide and water having relative concentration ratio thereof ranging from 1:1:5 to 3:1:5. Therefore, the examiner asserts that Lee one step etching solution is not more dilute than required by applicant's claim 1.

4. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not

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mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Conclusion

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan Vinh whose telephone number is 703 305-6302.

The examiner can normally be reached on M-F 8:30-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on 703 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are 703 872-9310 for regular communications and 703 872-9311 for After Final communications.

LV
July 10, 2003

